

## A NEW SPECIES OF DACTYLOPTERIDAE (PISCES) FROM THE PHILIPPINES AND AUSTRALIA, WITH A BRIEF SYNOPSIS OF THE FAMILY

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### ABSTRACT

A new species of helmet gurnard, *Dactyloptena tiltoni*, is described from the Philippines (type locality) and western Australia. It differs from the other species of the family by having a more pointed snout and multiple transverse ridges on its scales on the upper sides (rather than one strong transverse ridge). The family is represented in the Atlantic Ocean by *Dactylopterus volitans*, and in the Indo-Pacific by six species in the genus *Dactyloptena*.

The Dactylopteridae, also known as the Cephalacanthidae, is a small family of marine tropical and warm-temperate fishes. They are often called flying gurnards (Nelson, 1994), but no one has substantiated flight in these benthic, heavy-bodied fishes (Hubbs, 1933: 577-579); on the suggestion of P. C. Heemstra, Eschmeyer (1986, 1990) used the name helmet gurnards. Use of their long pectoral fins as a display or "warning behavior" has been discussed by Breder (1963); a nearly separate anterior portion of the fin is used to search for food (Poss, 1984). Young have small pectoral fins, and in at least some species, prejuveniles are pelagic. Adults live on soft or sandy bottom near shore to moderate depths. The relationships of the family are poorly known (Washington et al., 1984b); the family is most recently placed as a suborder of the Scorpaeniformes (Eschmeyer, 1990; Nelson, 1994). A fossil species, based on an adult from the Upper Eocene, has been described by Gayet and Barbin (1985); a 29-mm SL specimen described as *Cephalacanthus trispinosus* Ciobanu (1977) from the Oligocene recently has been shown to be a triacanthodid (Tyler et al., 1993).

No one has reviewed all species in the family. The most useful references for Indo-Pacific species are Jordan and Richardson (1908), de Beaufort in Weber and de Beaufort (1962), and Poss (1984); for Indian Ocean species see Eschmeyer (1986) and Manylo (1992). The single Atlantic species is treated in Eschmeyer and Dempster (1990). The purpose of this article is to describe the new species and to provide comparative information on the other species of the family.

### MATERIALS AND METHODS

In six of the seven species, one or two anterior dorsal fin spines precede the main spinous dorsal fin, and in these cases the isolated spines are denoted in the fin formula with a Roman numeral "I" followed by a plus sign (e.g., I+I+V+i,8); in some species the second spine is lost (I+0+V+i,8); the last spine (i) is very short, spinelike, and sometimes almost rudimentary. The last soft ray in the dorsal and anal fins is unbranched and well-separated from the preceding ray. Pectoral fin rays are difficult to count, especially the small posterior (lower) rays, and in some specimens they were not countable. Head length is from the tip of the snout to the posterior edge of the gill cover at or near dorsal attachment. Interorbital depth is measured with a gauge consisting of a calibrated thumb screw that is inserted in a small metal bar; the bar is placed across the interorbit and the screw turned until it touches the bottom of the interorbit as viewed from head-on (Eschmeyer and Poss, 1976). Other measurements are those commonly taken for teleosts, with the exception that measurements involving the "V" refer to the apex of the "V" at the postero-dorsal midline of the cranium (Fig. 3). Preopercle spine length is measured from the angle of the preopercle where the "hinge" bone connects the suborbital bones to the preopercle. Institutional abbreviations follow Leviton et al. (1985).

Table 1. Frequency distributions of selected meristics in species of Dactylopteridae

Species	Dorsal spines		Dorsal soft-rays		Anal rays		Vertebrae			Pectoral fin rays (both sides)									
	7	8	8	9	6	7	21	22	23	28	29	30	31	32	33	34	35	36	37
<i>volitans</i>	5		5		5		3									1	5	1	2
<i>orientalis</i>		7	7		7		3								3	1	8	2	
<i>peterseni</i>	4		4		4		4								2	4	2		
<i>gilberti</i>		13	13		12	1	13	1	7	9	4	8	1						
<i>papilio</i>		5	5		5		1	4			2	1	5						
<i>macracantha</i>		10	9	1	10		5					1	7	8	4				
<i>tiltoni</i> (types)	11		11		11		10				2	1	5						
<i>tiltoni</i> (other)	3		3		3		3			1	1	1	1						

## SYSTEMATICS

## Family Dactylopteridae

### Dactylopterinae Gill, 1861:43.

### Cephalacanthidae Kaup, 1873:79, 84.

*Remarks.*—This family is often called the Cephalacanthidae. It has been recognized since Canestrini (1861) and Günther (1877) that *Cephalacanthus* is based on the young and *Dactylopterus* on adults. The oldest available family-group name apparently is that of Gill (1861); *Les Cephalacanthes* and *Les Dactylopteres* of Lacepède (1801) being vernacular names.

**Diagnosis.**—Body elongate, squarish in cross-section, tapering behind. Head large, blunt; bones on top of head thick, fused into a bony shield. Interorbital wide, concave. Posttemporal bones extend far back, ending in a spine. Preopercle spine extremely long. Opercular spine absent, except in juveniles of *D. volitans*. Suborbital stay distinctive, and component bones poorly understood; stay attached to preopercle by an apparently unique "hinge bone" that is involved in movement (and locking) outward of the long preopercular spine. Mouth small, on underside of head; jaw teeth granular; no teeth on vomer or palatines. Scales strong, ctenoid, with transverse median ridge on each scale on upper sides (with more than one ridge in *D. tiltoni*). Two enlarged, modified scales on each side of body at base of caudal fin; 2–7 enlarged, modified movable scales on lower side before caudal fin. Lateral line present or absent, obscured by strong scales. Gill openings restricted. Dorsal fin rays I+I+V+i,8 or I+0+V+i,8 or VI+i,8. Pelvic rays I+4. Anal rays normally 6, no spines. Vertebrae normally 22; first two vertebrae elong-

Table 2. Interorbital width (as % standard length) and interorbital depth (as % head length) in species of Dactylopteridae

gate, third slightly elongate, and in Indo-Pacific species third vertebra with long paraphyses that curve out and up and attach to posttemporal bone in adults. Caudal fin truncate or slightly longer above and below. Pectoral fin in adults extremely long, inserted horizontally; 28–37 rays; usually first 5–7 rays short (and nearly separated from remainder), then increasing in length, with posterior (lower) rays very short and thin. Gasbladder complex, nearly divided into left and right halves, but joined at the middle. Gasbladder "drumming" muscle present. Where known, species are mostly brownish or reddish, body sometimes with saddles or dark spots; pectoral fins brightly colored, and color changes with growth; prominent ocellus in some young, dark-spotted, or dark with light-colored spots, or a combination of spots and streaks in adults.

### KEY TO THE GENERA AND SPECIES OF DACTYLOPTERIDS

- 1a. First two dorsal fin spines adjacent to each other, about equal in length, and not separated from remainder of spinous dorsal fin (Fig. 1A, see also Fig. 2A) (Atlantic Ocean) ..... *Dactylopterus volitans*
- 1b. One or two separate (free) dorsal fin spines well removed from remainder of spinous dorsal fin (Indo-Pacific) ..... *Dactyloptena* 2
- 2a. One free dorsal fin spine, just behind head (then a wide gap to remainder of dorsal fin) (Fig. 1B) ..... 3
- 2b. Two free dorsal fin spines, first behind head, second between longer first spine and remainder of spinous dorsal fin (Fig. 1C–D) ..... 4
- 3a. Snout pointed (Fig. 2B); only species with scales on sides with multiple transverse ridges on each scale, middle ridge slightly stronger (Philippines and Western Australia) ..... *Dactyloptena tiltoni* n. sp.
- 3b. Snout more rounded; scales on sides with single, strong, transverse knifelike ridge at middle of each scale (Western Pacific to East Africa) ..... *Dactyloptena peterseni*
- 4a. Interorbit extremely wide, about 16–23% of standard length (Fig. 2F–G) ..... 5
- 4b. Interorbit moderate, about 12–16% of standard length (Fig. 2A–E) ..... 6
- 5a. Posttemporal spine elevated at rear and not lying flat against body (see Fig. 2G) (Queensland to Western Australia) ..... *Dactyloptena papilio*
- 5b. Posttemporal spine lying flat against body (Japan, southeastern Asia, northern Indian Ocean) ..... *Dactyloptena giberti*
- 6a. Preopercular spine usually extending back farther than posttemporal spine; usually 1 dark blotch (often containing small pale spots) on pectoral fin, with center of spot at least halfway out on fin (Indo-Malayan region) ..... *Dactyloptena macracantha*
- 6b. Preopercular spine not extending back farther than posttemporal spine; many dark spots on pectoral fin (best defined in specimens over about 150 mm SL), one dark ocellus in small specimens to about 50–65 mm SL about  $\frac{1}{3}$  out on fin; usually upper sides and top of head with large dark spots in specimens over about 100 mm SL (Indo-Pacific) ..... *Dactyloptena orientalis*

### Genus *Dactylopterus* Lacepède, 1801

*Dactylopterus* Lacepède, 1801: 325 (type species *Gasterosteus pirapeda* Lacepède = *Gasterosteus volitans* Linnaeus, 1758, by subsequent designation of Jordan and Evermann, 1898: 2183).

*Cephalacanthus* Lacepède, 1801: 323 (type species *Gasterosteus spinarella* Linnaeus, 1758, by monotypy).

*Nomenclatural Remarks.*—*Dactylopterus* and *Cephalacanthus* were published simultaneously in the same work. The first reviser, selecting *Dactylopterus* over *Cephalacanthus*, apparently is Canestrini (1861). He did not specifically include *Cephalacanthus* in the synonymy of *Dactylopterus*, but in his plate (fig. 4e, 5e, 5\*, "var stadj del *Dactylopterus volitans*") he showed both adults and juveniles under the name *Dactylopterus*, and it is clear from the text that he knew that *Cephalacanthus* represented the young of *Dactylopterus*. If one does not accept Canestrini as the first reviser on technical grounds (International Code of Zoolog-

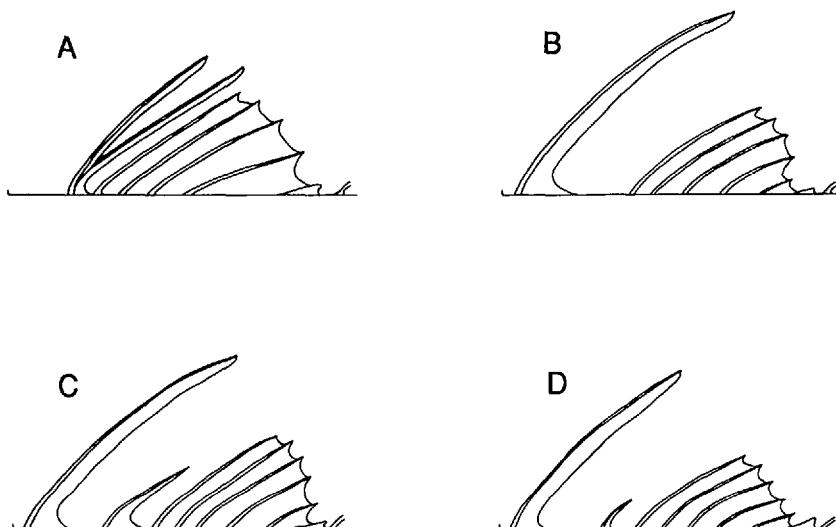


Figure 1. Diagrams of typical spacing of dorsal fin spines in adults of species of Dactylopteridae. (A) *Dactylopterus volitans*. (B) *Dactyloptena tiltoni* and *D. peterseni*. (C and D) *D. gilberti*, *D. papilio*, *D. macracantha* and *D. orientalis*. (Left end of base line corresponds to apex of "V" of cranium.)

ical Nomenclature, Art. 24), then Günther (1877: 169) serves as the first reviser with the same result.

**Diagnosis.**—First and second dorsal fin spines just in front of main portion of spinous dorsal fin, not immediately adjacent to cranium (Figs. 1A, 2A); first spine usually offset to the right side, second usually offset to the left side; their bases nearly touching. Parapophyses on third vertebra short, not attaching to posttemporal bones.

**Remarks.**—A single species, *Dactylopterus volitans* (Linnaeus, 1758). For a synonymy see Eschmeyer and Dempster (1990). Found in the Mediterranean Sea, both sides of the Atlantic, Ascension I., and often well offshore as young. Tropical and temperate areas at shallow depths to about 80 m.

#### Genus *Dactyloptena* Jordan and Richardson, 1908

*Dactyloptena* Jordan and Richardson, 1908: 665 (type species *Dactylopterus orientalis* Cuvier in Cuvier and Valenciennes, 1829, by original designation).

*Ebisinus* Jordan and Richardson, 1908: 664–665 (type species *Dactylopterus cheiropthalmus* Bleeker, 1854c, by original designation).

*Daicocus* Jordan and Richardson, 1908: 667 (type species *Dactylopterus peterseni* Nyström, 1887, by original designation).

**Diagnosis.**—First dorsal fin spine far forward, immediately behind cranium, isolated. Second spine present or absent; when present, second spine mid-way to two-thirds of distance from base of first spine to third spine (Fig. 1). Parapophyses on third vertebra attach to posttemporal bones.

**Remarks.**—In the Indo-West Pacific, sometimes two or three genera are recognized; for example, Okamura in Masuda et al. (1984) recognizes *Dactyloptena* and *Daicocus*. These separations have been made mostly on the basis of the configuration of the dorsal fin spines and presence or absence of a lateral line. The difference between having 2 or 1 free dorsal fin spine does not seem to

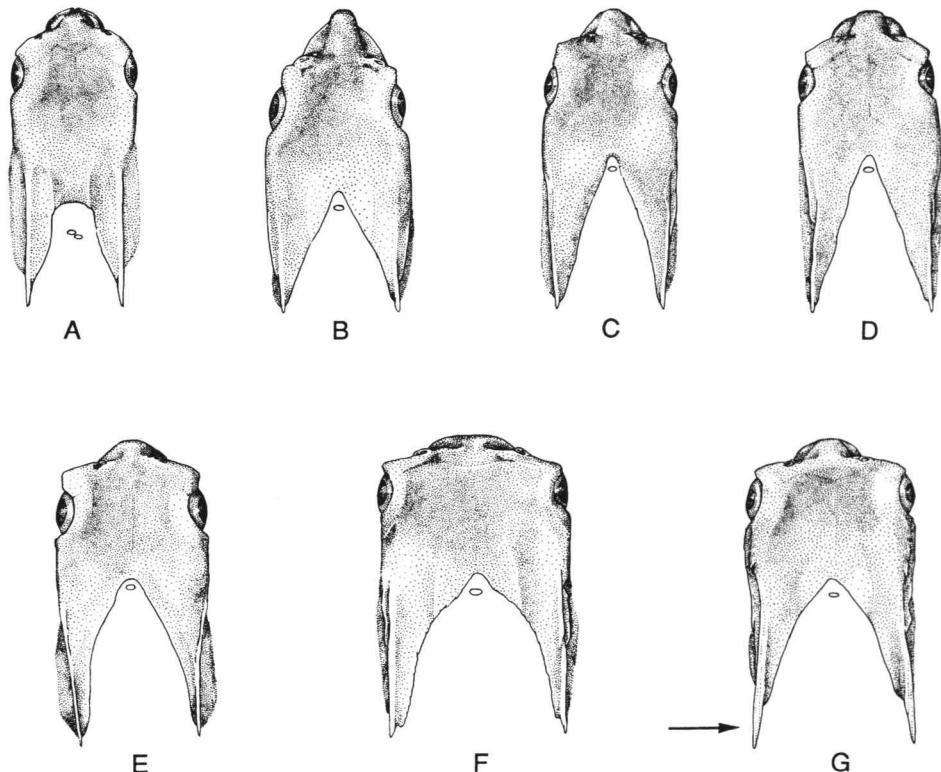


Figure 2. Dorsal view of head in adults of species of the family Dactylopteridae. (A) *Dactylopterus volitans* (SU 52409, 233 mm SL). (B) *Dactyloptena tiltoni* (CAS 32903, 94.0 mm SL). (C) *D. macracantha* (CAS 32881, 130 mm SL). (D) *D. peterseni* (CAS 15942, 200 mm SL). (E) *D. orientalis* (CAS 29281, 171 mm SL). (F) *D. gilberti* (CAS 22004, 151 mm SL). (G) *D. papilio* (AMS I.15557-252, 83.5 mm SL, arrow points to strong posttemporal spine).

warrant generic separation, and the condition of only 1 free spine results from the loss of the second, smaller spine (emphasis seems to have been to create a long flaglike first spine that in life can be held erect and vertical). Specimens of *Dactyloptena macracantha* typically have two free dorsal fin spines; sometimes specimens are found that lack the second spine, for example in 145 specimens in CAS 60774 and USNM 224473, three specimens lacked the second spine and in three specimens it was covered by skin. The lateral line is inconspicuous, not present in all species, but not correlated with any other clear-cut features. The Indo-Pacific species are here treated in one genus. Jordan and Richardson's three genera were published simultaneously. De Beaufort *in* Weber and de Beaufort (1962: 174), as first reviser, selected *Dactyloptena* and synonymized the other two genera with *Dactyloptena*.

*Dactyloptena tiltoni* new species  
Figures 2B, 3

**Diagnosis.**—Snout pointed (Figs. 2B, 3), much more than in other species—like a short rostrum; distance of tip of snout to front of eye nearly equal to interorbital width. Body scales on upper side with several wavy ridges on each scale, middle ridge stronger (in other five species there is only one very strong transverse ridge).

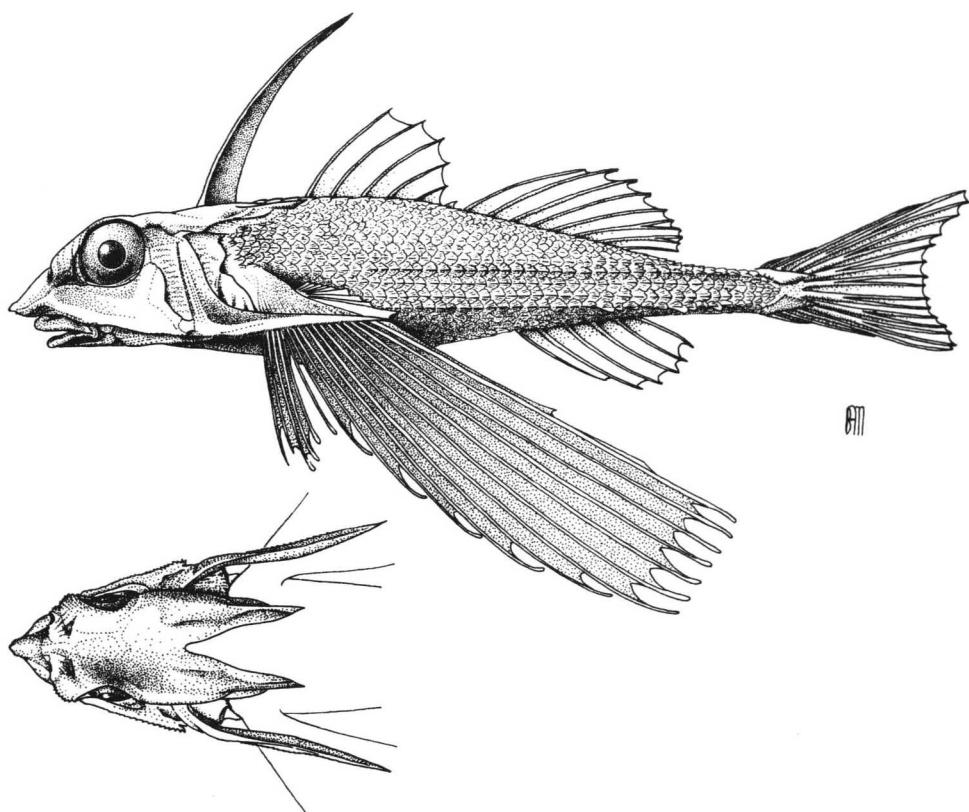


Figure 3. Lateral view and dorsal view of head of holotype of *Dactyloptena tiltoni*, CAS 32903.

**Description.**—See diagnoses for family and genus *Dactyloptena*. A small dactylopterid, apparently not exceeding 100 mm SL. Dorsal I+0+V+i,8; first spine long, free, located just behind "V" at rear of cranium; second spine absent, next five spines connected by membrane, spacing becoming wider posteriorly; sixth spine as a spinous lump just before eight rays of soft dorsal fin.

Coloration of preserved specimens brown to tan above, slightly paler below. No spots on upper sides. Membrane of first dorsal spine black. Pectoral fins mostly dusky, paler at edges, without a distinct spot or spots. Rays of soft dorsal fin faintly banded. Pelvic, anal, and caudal fins nearly pale. Color in life unknown.

Measurements of holotype in mm (% SL in parentheses): 94.0 mm SL, head length 28.3 (30.1), snout length 10.7 (11.4), interorbital width 12.1 (13.2), interorbital depth 2.1 (2.2), snout to "V" 26.2 (27.8), snout to tip of preopercle spine 50.9 (54.1), snout to tip of posttemporal spine 40.7 (43.3), orbit diameter 9.3 (9.9), tip of lower jaw to end of dentary 8.7 (9.2), predorsal fin length 26.1 (27.8), pectoral fin length (axil to tip longest ray) 69.3 (73.7), pelvic fin length 26.0 (27.6), first dorsal spine length 33.3 (35.4), "V" to tip of posttemporal spine 16.2 (17.2).

**Comparisons.**—This species differs from the other species in the snout and scale characters presented above and in the key. The three specimens from Australia, treated as additional material, share the snout and scale features, and seem to agree in all other features.

**Distribution.**—Known from the type material from the Philippines and from the additional specimens from Western Australia. Depths of capture range from 119 to 556–565 m; the deepest living dactylopterid.

**Etymology.**—The species is named for Mr. Thomas Tilton, of San Francisco, in appreciation for the support of the Tilton family of the research activities at the California Academy of Sciences.

**Material Examined.**—Holotype: CAS 32903, 94.0 mm SL, Philippines, Ragay Gulf, Buir Pt., 556–565 m, J.E. Norton, sta. 116, 15 Nov. 1966.

Paratypes: Philippines, trawled, collected by J.E. Norton in 1966. CAS 47964 (1, 94.5 mm SL) taken with holotype; CAS 33853 (94.0 mm SL) Marinduque, southeast of Salomague I., 287–313 m, sta. 108, 20 Oct.; CAS 32799 (1, 73.5 mm SL) Marinduque I., southeast of Salomague I., 119–132 m, sta. 93, 25 Aug.; CAS 33365 (1, 90.2) Quezon, Catuanan, Sandoval Pt., 128–143 m, sta. 110, 3 Nov.; CAS 32684 (2, 66.8–70.7 mm SL) Luzon I., Batangas Bay, southeast of Talaga, 240–252 m, sta. 66, 26 July; CAS 32807 (1, 74.2) Luzon I., Batangas Bay, Mainaga Cove, 159–187 m, sta. 50, 8 July; CAS 32893 (1, 70.6 mm SL), CAS 47986 (1, 65.5 mm SL, cleared and stained) and AMS I.26946-001 (1, 74.5 mm SL) Luzon I., Batangas, Balayan Bay, off Lemery Town, 155–165 m, sta. 45, 27 June.

**Additional Non-type Material.**—Western Australia, trawled. AMS I.21616-005 (81.8 mm SL), 12°57'S, 124°20'E, R/V COURAGEOUS, 188–190 m, 8 June 1979; AMS I.22829-018 (91.2 mm SL) and CAS 84177 (82.9 mm SL) 19°06'S, 117°14'E, J. Paxton on vessel SOELA, 152–158 m, 14 Apr. 1982 [taken with 6 specimens of *D. peterseni*].

### *Dactyloptena peterseni* (Nyström, 1887)

*Dactylopterus peterseni* Nyström 1887: 24 (original description, type locality Nagasaki, Japan).

**Material Examined.**—JAPAN, MISAKI: SU 23527 (6); SU 68787 (1, cleared and stained); USNM 152533 (1). TAIWAN: CAS 29979 (2) Formosa Banks, about 50 m; CAS 15942 (2) about 26°N, 121°E, 90 m, mud bottom. SOUTH CHINA SEA: CAS 29284 (1) 20°04'N, 111°58'E, 93 m; SU 67358 (1) 19°11'N, 112°20'E, 205–209 m. INDIA: CAS 35182 (1) Bay of Bengal. MOZAMBIQUE: CAS 48672 (1) Inhambane; RUSI 14411 (1) Inhambane; SU 66555 (3) 25°05'30" to 25°05'S, 34°45'12"E to 34°42'E, 95–105 m. WESTERN AUSTRALIA: AMS I.22805-010 (4) 18°28'S, 118°15'E, 150–156 m; AMS I.22807-032 (1) 18°32'S, 118°17'E, 200–204 m; AMS I.22828-004 (2) 19°01'S, 117°12'E, 200–202 m; AMS I.22829-011 (6) W. Australia, 19°06'S, 117°14'E, 152–158 m; WAM P.26193-017 (1) 19°17'S, 116°16'E, 170–172 m.

**Diagnosis.**—Snout blunt, but a little more pointed than in other species except *D. tiltoni*. Scales on back with one strong, knife-like transverse ridge on each scale, no secondary ridges. Dorsal I+0+V+i,8; first spine free, long, just behind "V" of cranium; second spine absent. Pectoral fins spotted in large adults, nearly overall dusky in smaller specimens or a dark ocellus about one-third out on fin. Usually dark spots on back in larger specimens. Maximum total length to about 250 mm.

**Comparisons.**—This species and *D. macracantha* are similar. They are most easily separated by the absence of the second dorsal fin spine in *D. peterseni* and its presence in *D. macracantha*; however the second spine is occasionally absent in *D. macracantha*. In *D. macracantha* there is normally a well-marked dark blotch (usually punctuated with pale spots) halfway out on the pectoral fins; when a large dark spot is present in *D. peterseni* it is on the first third of the fin.

**Distribution.**—Japan, south throughout the Indian Ocean to east Africa, Western Australia. Few depths available, about 50–210 m.

### *Dactyloptena gilberti* Snyder, 1909

*Dactyloptena gilberti* Snyder, 1909: 604 (original description, Kagoshima, Japan; holotype USNM 62952)

*Dactyloptena jordani* Franz, 1910: 80 (original description, Japan).

**Material Examined.**—JAPAN: USNM 62952 (1, 159 mm SL, holotype of *D. gilberti*) Japan, Kagoshima; SU 22004 (1) same locality as holotype. GULF OF THAILAND: CAS 47158 (1) 12°31'–34°30"N, 100°44'30"–47°16'E; CAS 47158 (1) 12°09'30"–12°18"N, 100°21'00"–22°45'E; CAS 59260 (1) 12°07'N, ca. 100°17'E; CAS 47134 (1), vicinity of Goh Chuang, about 32–34 m; CAS 47139 (1) 11°52'N, 100°19'E; CAS 31302 (1, cleared and stained) 10°21'12"N, 102°19'11"E, dipnet at surface; CAS 47164 (2, cleared and stained) 7°38'42"N, 101°19'42"E, at surface. An additional 131 specimens are at CAS (CAS 47132–47166) from the Gulf of Thailand in depths of 20–71 m. INDIA: SU 41062 (2) Madras. SRI LANKA: USNM 224470 (1) Trincomalee, beach seine [check if young]. BAHRAIN: BPBM 21179 (1); USNM 267094 (1) 26°39'12"N, 51°08'06"E, 23–24 m. OMAN: CAS 35187 (1) 20°50'N, 59°10'E, 73 m. ARABIAN SEA: CAS 35187 (1) 20°50'N, 59°10'E.; CAS 35186 (1) 25°04'N, 65°56'E, 26 m. SOMALIA: USNM 285976 (1) 11°04'48"N, 51°11'12"E, 61 m; CAS 35198 (1) 11°11'N, 51°14'E, 47–49 m; CAS 35189 (1) 10°03'N, 51°15'E, 31–39 m.

**Diagnosis.**—Snout blunt. Scales on upper sides with one transverse ridge, no secondary ridges. Dorsal I+I+V+i,8; first spine free and just behind "V" of cranium; second spine smaller, about midway between first spine and remainder of dorsal fin. Interorbit extremely wide, about 75% of head length. Pectoral fins dusky or with large brown spots in rows, especially dark on area of middle fin rays, anterior nearly-separate portion of fin paler, no large ocellus or spot. Dark saddles on back. Maximum total length to about 220 mm.

**Juveniles.**—Based on alcohol-preserved specimens about 30–35 mm SL. Interorbit about  $\frac{1}{3}$  of standard length. Pectoral fins mostly black, no large dark spot or ocellus; lower rays pale, with small brown spots; extreme tips of longest rays clear. Rays of soft dorsal fin and caudal fin with small brown spots. Posttemporal spine and first dorsal fin banded with brown. Posttemporal spine extends to middle of spinous dorsal fin; preopercular spine extends to over front of anal fin.

**Remarks.**—See *D. papilio* below.

**Distribution.**—Southern Japan and Gulf of Thailand to India and to Africa. Gulf of Thailand specimens were captured in 20–71 m over sand or mud and sand bottom.

*Dactyloptena papilio* Ogilby, 1910

*Dactyloptena papilio* Ogilby, 1910a: 127 (original description, Queensland, Australia, 13–37 m).

**Material Examined.**—WESTERN AUSTRALIA: WAM P.28354-001 (1) 27°02'S, 153°28'E, 120 m; WAM P.5960 and WAM P.13941 (1) 25°21'S, 113°44'E; WAM P.14817-18 (2), WAM P.23389-93 (5) and WAM P.23395 (1) 22°15'S, 114°05'E; WAM P.5354 (1), WAM P.6062 (1, 94.0), WAM P.9063 (1), WAM P.9064-65 (2), WAM P.7156 (1), WAM P.23852 (1) and WAM P.28356-001 (2) 22°05'S, 114°15'E; WAM P.16292 (1) 21°53'S, 114°52'E; WAM P.25398-001 (1, 171) 17°31'S, 121°27'E, 81 m; WAM P.28355-001 (2, 135–185) 20°18'S, 118°35'E, 135–185 m; WAM P.26259-008 (1) 16°20'S, 122°19'E, 50–52 m. AUSTRALIA, NORTHERN TERR.: AMS I.12842-022 (4) Arafura Sea, 10°35'–37'S, 133°45'–47'E, 60 m [2 specimens of *D. macracanthus* from same station]; WAM P.14242-43 (2) 12°27'S, 130°50'E. QUEENSLAND: WAM P.14510 (1) 11°05'S, 130°50'E; AMS I.15557-252 (7) Gulf of Carpenteria, 16°29'S, 140°03'E, 27 m. ANSP 122441 (1) Great Barrier Reef, north of Palm I.

**Diagnosis.**—Dorsal I+I+V+i,8; first spine free and just behind "V" of cranium; second spine smaller, about midway between first spine and remainder of dorsal fin. Pectoral fins with a grouping of dark spots or a vague dark area near base and extending about  $\frac{1}{3}$  out on fin. Faint dark saddles on back in midsized specimens (80–120 mm SL). Maximum total length to about 220 mm.

**Remarks.**—This species and *D. gilberti* appear to be closely related. They have an extremely wide head (Fig. 2F, G). Both have the second dorsal fin spine present, and they have similar pectoral fin coloration, although in *D. gilberti* the pectoral fin often is darker over a broader area. In *D. papilio* the posttemporal

spine [at end of each arm of "V", adjacent to dorsal fin] is stronger and distally more elevated above the plane of the cranium (see arrow in Fig. 2G). Sculpturing on the head is different; in *D. papilio* the head is covered nearly uniformly with small indentations, while indentations are more irregular and arranged more in rows in *D. gilberti*. The snout has small granular projections arranged uniformly in *D. papilio*, while in *D. gilberti* they are arranged in rows. The snout is a little more pointed in *D. papilio*, more rounded and wider in *D. gilberti*.

**Distribution.**—Western and northern Australia, and Arafura Sea. Few depths of capture known, about 13–137 m.

### *Dactyloptena macracantha* (Bleeker, 1854)

*Dactylopterus macracanthus* Bleeker, 1854b: 449 (original description; Makassar [Ujung Pandang, Indonesia]; no types known).

**Material Examined.**—PHILIPPINES: ANSP 145955 (5); CAS 32881 (1) Marinduque I., 112–119 m; CAS 32655 (4) Luzon I., 46–55 m; CAS 32837 (1) Luzon I., 128–177 m; CAS 49540 (2) Luzon I., 64 m; CAS 32812 (1) Luzon I., 71–80 m; CAS 32673 (2) Luzon I., 46–55 m; CAS 32913 (1) Luzon I., 110–123 m; CAS 60774 (10) and USNM 224473 (135) Luzon I., Manila fish market; SU 9657 (2) Cavite; USNM 150887 (3) Port Binanga; USNM 169169 (1) Balayan Bay, Taal; USNM 258909 (1) 11°30'N, 124°40'12"E, 50–70 m; USNM 258911 (151) Visayan Sea. GULF OF THAILAND: CAS 47989 (2) ca. 12°25'45"—26°30'N, 101°20'45"—26'00"E; CAS 60507 (1) vic. Goh Chuang, 32–34 m; CAS 60733 (1) 11°46'00"—53°00'N, 100°36'—45"E; CAS 60735 (1) 11°52'—12°14'N, 109°19'—23'E; CAS 60732 (2) 12°26'00"—27°30'N, 101°20'30"—26'00"E; CAS 60734 (2) 12°31"—34°30'N, 100°44'30"—47°15"E, 40 m; CAS 60731 (3) 11°25'00"—45°30'N, 99°43'—53'E, 12–22 m; CAS 60736 (2) 12°23'00'N, 100°33'00"E, 36 m; CAS 35190 (1) 8°46'N, 97°46'E, 82–77 m. MALAY PENINSULA: SU 32131 (2) east coast. EAST CHINA SEA: CAS 30589 (1) Formosa Banks, 91 m. INDIA: BPBM 20646 (1) Madras; BPBM 27546 (4) Cochin; CAS 41063 (1) Gopalpur. ANDAMAN SEA: CAS 35177 (38) 9°13'N, 97°51'E; CAS 35179 (1) 14°07'N, 97°05'E; CAS 35180 (1) 15°08'N, 94°54'E; CAS 35181 (2) 15°08'N, 94°04'E; CAS 35178 (3) 9°54'N, 97°42'E. BAY OF BENGAL: CAS 35178 (3) 9°54'N, 97°42'E; CAS 35182 (37) and CAS 47987 (2, cleared and stained) 21°00'N, 91°59'E; CAS 35833 (62) 19°32'N, 92°52'E. SRI LANKA: USNM 206117 (1) Wadge Bank, 8°03'N, 77°13'E, 53 m; USNM 224471 (1) Mutwal Harbor, 64 m; USNM 224472 (1) Wadge Banks, 8°02'N, 77°12'E, 49–60 m; USNM 28861 (1) 7°48'N, 80°01'E, 49 m. SUMATRA: CAS 53136 (1) 00°04'S, 99°01'E, 50 m. JAVA: CAS 53137 (1) 8°33'S, 114°31'30"E 62–68 m; SU 49321 (1) no other data. AUSTRALIA, NORTHERN TERR., ARAFURA SEA: AMS I.21950-004 (3) 8°53'—54'S, 135°10'—14'E, 78–88 m; CAS 60773 (2) and AMS I.21842-037 (2) 10°35'—37'S, 133°45'—47"E, 60 m [four *D. papilio* also taken at this station].

**Diagnosis.**—Dorsal I+I+V+i,8 [rarely I+0+v+i,8]; first spine free, long, just behind "V" of cranium; second spine short, about midway between first spine and remainder of dorsal fin. Pectoral fins dusky, with faint pale spots, usually with one large dark spot (usually containing small pale spots) about two-thirds out on fin. Total length to at least 240 mm.

**Distribution.**—Japan, the Philippines, Malay Peninsula, northern Indian Ocean, and Indo-Australian Archipelago to Australia. Depths of capture are about 45 to about 125 m, one collection 128–177 m.

### *Dactyloptena orientalis* (Cuvier, 1829)

*Dactylopterus orientalis* Cuvier in Cuvier and Valenciennes, 1829: 234 (original description; Coromandel coast, Bay of Bengal, India).

*Dactylopterus japonicus* Bleeker, 1854a: 396 (original description; Nagasaki, Japan).

*Dactylopterus cheiropthalmus* Bleeker, 1854c: 494 (original description; Banda).

*Ebisinus procne* Ogilby, 1910b: 34 (original description; Moreton Bay, Queensland, Australia).

**Material Examined.**—JAPAN: BPBM 13365 (1) Miyake-Jima; SU 20694 (3) Wakanoura, Kii Is. RYUKYU Is.: USNM 132676 (1). CHINA: AU 29059 (1) Swatow. TAIWAN: USNM 76651 (3). SOUTH CHINA SEA: CAS 29283 (1) 21°N, 112°19'W. PHILIPPINES: SU 27467 (1) Dumaguete. SOMALI COAST: CAS 35189 (1) 10°03'N, 51°15'E. MOZAMBIQUE: ANSP 122509 (1), Delagoa Bay. RUSI 13300 (1) Ibo.

MAURITIUS: USNM 76317 (1). SOUTH AFRICA: RUSI 5371 (1); RUSI 5911 (1); RUSI 7150 (1); RUSI 8208 (1); RUSI 8663 (3); RUSI 12782 (1). PALAU Is.: BPBM 10607 (1), CAS 29281 (1), CAS 29282 (1). HAWAII: CAS 29276 (1); CAS 23402 (1); CAS 31116 (1, cleared and stained); SU 7853 (2); CAS 28871 (1) French Frigate Shoals; additional specimens from Hawaii are at ANSP, BPBM, CAS and USNM. NEW HEBRIDES: ANSP 71381 (1). SAMOA: USNM 152264 (1) Pago Pago. FIJI: USNM 176641 (1) off Suva. WESTERN AUSTRALIA: WAM P.4362 (1), WAM P.5864 (1), WAM P.8173 (1) and WAM P.13796-97 (2) 25°21'S, 113°44'E; WAM P.4274 (1), 24°37'S, 113°11'E; WAM P.23389-001 (1) 22°15'S, 114°05'E; WAM P.25095-001 (1) 22°05'S, 114°15'E, 12 m; WAM P.23902-001 (1) 21°47'S, 114°10'E. AUSTRALIA: SU 20562 (1); SU 20537 (1); ANSP 90512 (1); ANSP 12296 (1); SU 20562 (1). SOCIETY Is.: ANSP 82846 (4); ANSP 82346 (1); CAS 7041 (2); CAS 7449 (1); CAS 28872 (2); SU 7853 (2). RAPA: BPBM 13078 (1). MARQUESAS Is.: CAS 28870 (3). PITCAIRN: BPBM 16833 (1).

**Diagnosis.**—Dorsal I+I+V+i,8; first spine free, just behind "V" at rear of cranium; second spine smaller, isolated, about  $\frac{2}{3}$  distance from base of first spine to remainder of dorsal fin. Lateral line present but difficult to see (better marked in young). Pectoral fins densely dark-spotted in adults, with streaks of pale. In largest specimens (over about 150 mm SL) pectoral fins mostly dark-blotched and spotted, with tiny pale spots, the latter arranged in lines on distal  $\frac{1}{3}$  of fin. Dark spots (sometimes surrounded by pale) on upper back and tip of head in specimens over about 100 mm SL. Reported to total lengths of about 400 mm.

**Juveniles.**—Juveniles (about 10–40 mm SL) have the head bones more honeycombed than in adults, and parietal spines are evident in the "V" behind the cranium. Pectoral fins irregularly dark-blotched, with an ocellus or dark area about  $\frac{1}{3}$  out on fin, ocellus present in specimens up to about 65 mm SL. Back with four saddles, no large spots.

**Distribution.**—Extremely widespread, occurring from the African coast east to Hawaii and the Society Islands, Pitcairn and Rapa, Japan south to Australia. A shallow-living species, benthic as adults. Prejuveniles are pelagic and will come to a light at night. This species is the only one found at oceanic islands.

**Remarks.**—The placement of *D. cheiropthalmus* needs further investigation. No type exists and Bleeker did not figure this species. De Beaufort in Weber and de Beaufort (1962) treats it as a synonym of *D. macracanthus*; some earlier authors placed it as the young of *D. orientalis*.

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